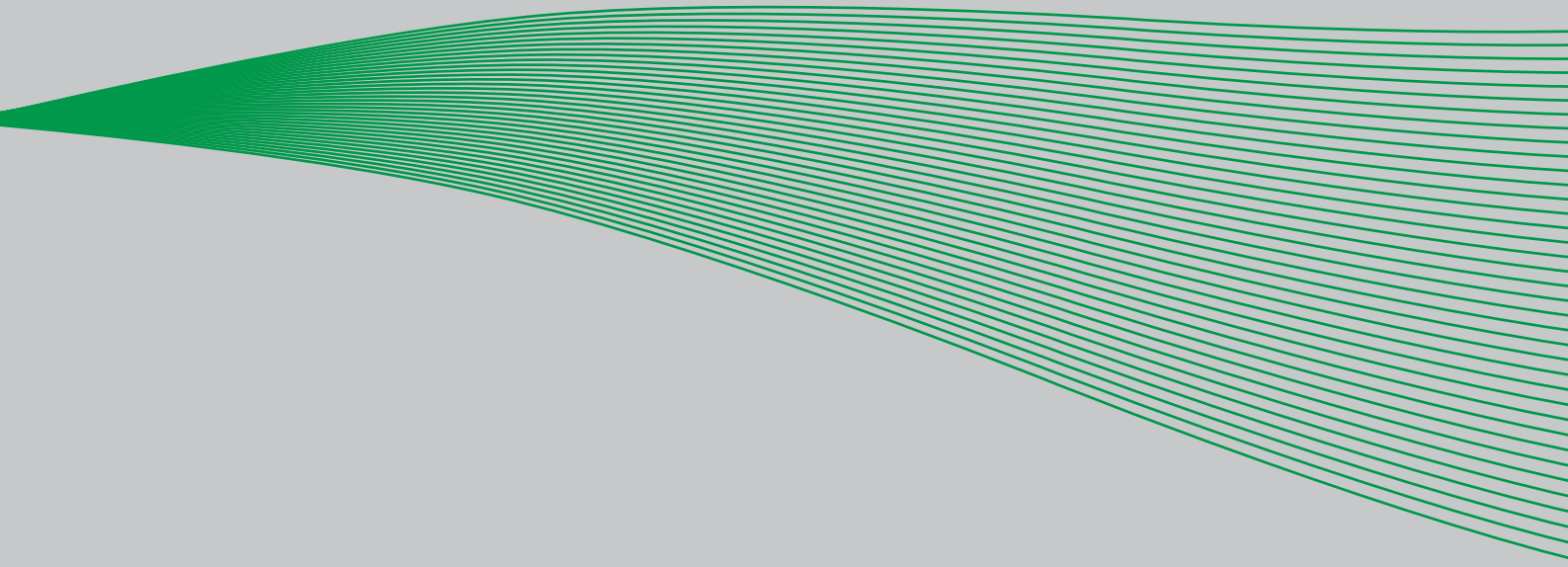
VACON® 100
AC DRIVES

# INTEGRATED BACNET INSTALLATION MANUAL



VACON®
DRIVEN BY DRIVES

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# 1. SAFETY

This manual contains clearly marked cautions and warnings that are intended for your personal safety and to avoid any unintentional damage to the product or connected appliances.

**Please read the information included in cautions and warnings carefully.**

The cautions and warnings are marked as follows:

*Table 1. Warning signs*

| | |
|---|---|
| | **= DANGER! Dangerous voltage** |
| | **= WARNING or CAUTION** |
| | **= Caution! Hot surface** |

## 1.1 DANGER

| | |
|---|---|
| | The **components of the power unit are live** when the drive is connected to mains potential. Coming into contact with this voltage is **extremely dangerous** and may cause death or severe injury. |
| | The **motor terminals U, V, W and the brake resistor terminals are live** when the AC drive is connected to mains, even if the motor is not running. |
| | **After disconnecting** the AC drive from the mains, **wait** until the indicators on the keypad go out (if no keypad is attached, see the indicators on the cover). Wait 5 more minutes before doing any work on the connections of the drive. Do not open the cover before this time has expired. After expiration of this time, use a measuring equipment to absolutely ensure that no voltage is present. **Always ensure absence of voltage before starting any electrical work!** |
| | The control I/O-terminals are isolated from the mains potential. However, the **relay outputs and other I/O-terminals may have a dangerous control voltage** present even when the AC drive is disconnected from mains. |
| | **Before connecting** the AC drive to mains make sure that the front and cable covers of the drive are closed. |
| | During a ramp stop (see the Application Manual), the motor is still generating voltage to the drive. Therefore, do not touch the components of the AC drive before the motor has completely stopped. Wait until the indicators on the keypad go out (if no keypad is attached, see the indicators on the cover). Wait additional 5 minutes before starting any work on the drive. |



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## 1.2 WARNINGS

| | |
|---|---|
| | The AC drive is meant for **fixed installations only**. |
| | **Do not perform any measurements** when the AC drive is connected to the mains. |
| | The **earth leakage current** of the AC drives exceeds 3.5mA AC. According to standard EN61800-5-1, **a reinforced protective ground connection** must be ensured. See Chapter 1.3. |
| | If the AC drive is used as a part of a machine, the **machine manufacturer is responsible** for providing the machine with a **supply disconnecting device** (EN 60204-1). |
| | Only **spare parts** delivered by Vacon can be used. |
| | At power-up, power brake or fault reset **the motor will start immediately** if the start signal is active, unless the pulse control for Start/Stop logic has been selected. Furthermore, the I/O functionalities (including start inputs) may change if parameters, applications or software are changed. Disconnect, therefore, the motor if an unexpected start can cause danger. |
| | The **motor starts automatically** after automatic fault reset if the auto restart function is activated. See the Application Manual for more detailed information. |
| | **Prior to measurements on the motor or the motor cable**, disconnect the motor cable from the AC drive. |
| | **Do not touch the components on the circuit boards**. Static voltage discharge may damage the components. |
| | Check that the **EMC level** of the AC drive corresponds to the requirements of your supply network. |
| | Wear protective gloves when you do mounting, cabling or maintenance operations. There can be sharp edges in the AC drive that can cause cuts. |

## 1.3 EARTHING AND EARTH FAULT PROTECTION

**CAUTION!**

The AC drive must always be earthed with an earthing conductor connected to the earthing terminal marked with ⏚.

The earth leakage current of the drive exceeds 3.5mA AC. According to EN61800-5-1, one or more of the following conditions for the associated protective circuit must be satisfied:

a) The protective conductor must have a cross-sectional area of at least 10 mm2 Cu or 16 mm2 Al, through its total run.

b) Where the protective conductor has a cross-sectional area of less than 10 mm2 Cu or 16 mm2 Al, a second protective conductor of at least the same cross-sectional area must be provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm2 Cu or 16 mm2 Al.

c) Automatic disconnection of the supply in case of loss of continuity of the protective conductor.

The cross-sectional area of every protective earthing conductor which does not form part of the supply cable or cable enclosure must, in any case, be not less than:

- 2.5mm² if mechanical protection is provided or
- 4mm² if mechanical protection is not provided.

The earth fault protection inside the AC drive protects only the drive itself against earth faults in the motor or the motor cable. It is not intended for personal safety.

Due to the high capacitive currents present in the AC drive, fault current protective switches may not function properly.

**Do not perform any voltage withstand tests** on any part of the AC drive. There is a certain procedure according to which the tests must be performed. Ignoring this procedure may result in damaged product.

**NOTE! You can download the English and French product manuals with applicable safety, warning and caution information from www.vacon.com/downloads.**

**REMARQUE Vous pouvez télécharger les versions anglaise et française des manuels produit contenant l'ensemble des informations de sécurité, avertissements et mises en garde applicables sur le site www.vacon.com/downloads.**



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# 2. BACnet - general info

**BACnet** stands for 'Building Automation and Control Networks'. It is the common name for the communication standard ISO 16484-5 which defines the methods and the protocol for cooperating building automation devices to communicate. Devices can be designed to operate using BACnet communication protocol as well as utilising BACnet protocol to communicate between systems. BACnet is an internationally accepted protocol for building automation (e.g. lightning control, air conditioning and heating automation) and control over a communications network.

BACnet provides a method by which computer-based control equipment, from different manufacturers can work together, or 'interoperate'. For this to be achieved, components must be able to exchange and understand BACnet data messages.

Your Vacon® 100 drive is equipped with BACnet support as standard.

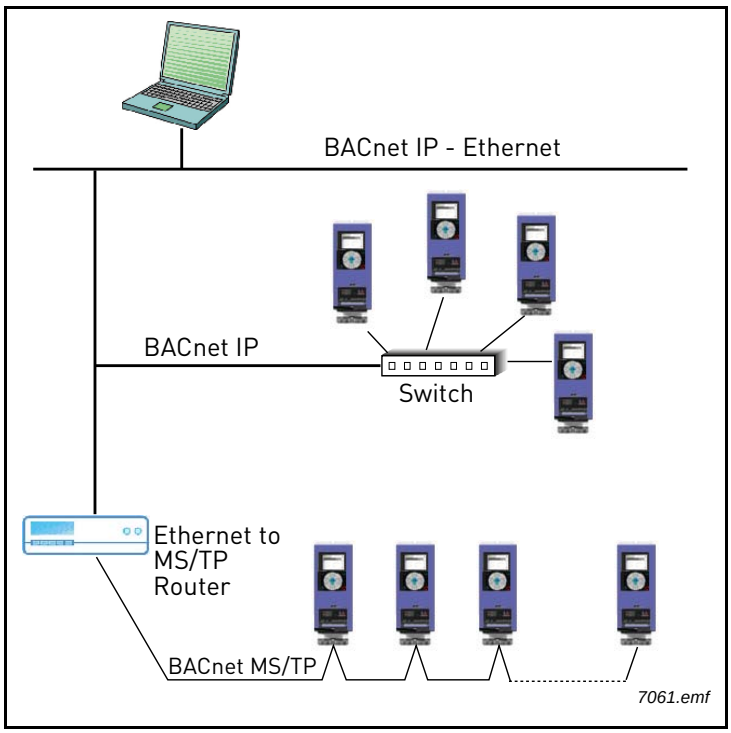


*Figure 1. Principal example diagram of BACnet*

If you have problems related to BACnet, contact tech.supportVDF@vacon.com. Send a description of the problem and the drive's *Service Information* file. You can download the Service Information file with the Vacon Live tool. In BACnet/IP networks, also send a log file captured with the Wireshark tool that contains the error situation.

# 3. BACNET TECHNICAL DATA

## 3.1 BACNET MS/TP PROTOCOL

*Table 2.*

| | | |
|---|---|---|
| **Connections and communications** | Interface | RS-485 |
| | Data transfer method | RS-485 MS/TP, half-duplex |
| | Transfer cable | STP (Shielded Twisted Pair), type Belden 9841 or similar |
| | Connector | 2.5 $mm^2$ |
| | Electrical isolation | Functional |
| | BACnet MS/TP | As described in ANSI/ASHRAE Standards 135-2010 Ver.1 Rev.12 |
| | Baud rate | 9600, 19200, 38400 and 76800 baud(supports autobaud detection) |

## 3.2 BACNET IP PROTOCOL

*Table 3.*

| | | |
|---|---|---|
| **Connections and communications** | Interface | 100BaseTX, IEEE 802.3 compatible |
| | Data transfer method | Ethernet half/full -duplex |
| | Data transfer speed | 10/100 MBit/s, autosensing |
| | Protocol | BACnet over UDP/IP |
| | Connector | Shielded RJ45 connector. |
| | Cable type | CAT5e STP |
| | BACnet IP | As described in ANSI/ASHRAE Standards 135-2010 Ver.1 Rev.12 |
| | IP address mode | Selectable: Static or DHCP |



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# 4. PROGRAMMING

You will find basic information on how to use the control keypad in the Application Manual of your Vacon® 100 drive.

Below you will find some examples of navigation paths to the fieldbus parameters.

*Table 4.*

| | |
|---|---|
| 1. First ensure that the right fieldbus protocol is selected. | |
| | Activating BACnet MSTP (P5.8.1.1)<br>Main Menu > I/O and Hardware > RS-485 > Common settings > Protocol > **BACnet MSTP** <<br><br>Activating BACnet IP (P5.9.3.1.4)<br>Main Menu > I/O and Hardware > Ethernet > Bacnet IP > Protocol in use > **Yes** < |
| 2. Select *'Fieldbus control'* as the *Remote Control Place*. | |
| | Control Place (P3.2.1)<br>Main Menu > Parameters > Start/Stop Setup > Rem Control Place > **FieldbusCTRL** < |
| 3. Activate Remote control. | |
| | Local/Remote (P3.2.2)<br>Main Menu > Parameters > Start/Stop Setup > Local/Remote > **Remote** < |
| 4. Set up Protocol Parameters. | |
| | BACnet MS/TP parameters see Chapter 4.1<br>BACnet IP parameters see Chapter 4.2 |

## 4.1 BACNET MS/TP PARAMETERS AND MONITORING VALUES

*Table 5. Parameters related with BACnet used through MS/TP*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P5.8.3.1.1 | Baud rate | 9600 | 76800 | 9600 | 2392 | Communication speed<br>1 = 9600<br>2 = 19200<br>3 = 38400<br>4 = 76800<br>5 = Autobaud |
| P5.8.3.1.2 | MAC Address | 1 | 127 | 1 | 2331 | BACnet device MAC address |
| P5.8.3.1.3 | Instance number | 0 | 4194304 | automatic | 2332 | Device Object's instance number.<br>0 = Automatically<br>generated from the last 22 bit from Ethernet MAC address. |
| P5.8.3.1.4 | MaxMaster | 1 | 127 | 127 | 2561 | Max Master parameter of device object. This can be used to reduce poll for master cycles. |
| P5.8.3.1.5 | Communication time-out | 0 | 65535 | 10 | 2333 | Defines the number of seconds after which a communication timeout is indicated after a communication break. Value 0 disables this feature. |

*Table 5. Parameters related with BACnet used through MS/TP*

| | | | | | | |
|---|---|---|---|---|---|---|
| P5.8.3.1.6 | MaxAPDUcycle | 0 | 65535 | 0 | 2554 | Defines the number of seconds after which the next application level message is shown after a communication break. Value 0 disables this feature. |

*Table 6. Monitoring values*

| Code | Parameter | Min | Max | ID | Description |
|---|---|---|---|---|---|
| P5.8.3.2.1 | Fieldbus protocol status | INITIALIZING | INACTIVE | 2393 | See Table 12 |
| P5.8.3.2.2 | Communication status | 0.0 | 99.999 | 2394 | Counter for failed and good messages failed msg's <-> good msg's |
| P5.8.3.2.3 | Actual instance | 0 | 4194304 | 2395 | Actual instance in use. If the instance parameter is 0, the generated instance number shows here. |
| P5.8.3.2.4 | Last fault | See fault codes (table Table 11) | | 2396 | Information about the latest fault detected. |
| P5.8.3.2.5 | UartDBG | 0.0.0 | 32767. 32767. 32767 | 2559 | Uart error counters in the following order: framing errors. overrun errors. parity errors. |
| P5.8.3.2.6 | ActiveCOVcount | 0 | 20 | 2558 | Number of active COV subscriptions |

## 4.2 BACnet IP parameters and monitoring values

### 4.2.1 Ethernet common settings

*Table 7. Common settings for Ethernet Interface*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P5.9.1.1 | IP address mode | 0 | 1 | | 1 | 2482 | 0 = Fixed IP<br>1 = DHCP with AutoIP |

*Table 8. Fixed IP*

| Code | Parameter | Min | Max | Unit | Default | ID | Description |
|---|---|---|---|---|---|---|---|
| P5.9.1.2.1 | IP address | | | | 192.168.0.10 | 2529 | The parameter is in use if P5.9.1.1 = 0/Fixed IP |
| P5.9.1.2.2 | Subnet mask | | | | 255.255.0.0 | 2530 | The parameter is in use if P5.9.1.1 = 0/Fixed IP |
| P5.9.1.2.3 | Default gateway | | | | 192.168.0.1 | 2531 | The parameter is in use if P5.9.1.1 = 0/Fixed IP |
| P5.9.1.3 | IP address | | | | 0 | 2483 | IP address in use |
| P5.9.1.4 | Subnet mask | | | | 0 | 2484 | Subnet mask in use |
| P5.9.1.5 | Default gateway | | | | 0 | 2485 | Default gateway in use |
| P5.9.1.6 | MAC address | | | | | 2486 | MAC address |



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### 4.2.2 BACNET IP SETTINGS

*Table 9. Parameters related with BACnet used through Ethernet*

| Code | Parameter | Min | Max | Default | ID | Description |
|---|---|---|---|---|---|---|
| P5.9.3.1.1 | Instance number | 0 | 4194304 | automatic | 2406 | Device Object's instance<br>0 = Automatically generated from the last 22 bit from the Ethernet MAC address. |
| P5.9.3.1.2 | BACnet Port Number | 47808 | 47823 | 47808 | 2538 | UDP port for BACnet IP communication. |
| P5.9.3.1.2 | Communication time-out | 0 | 65535 | 10 | 2407 | Defines the number of seconds after which a communication timeout is indicated after a communication break. Value 0 disables this feature. |
| P5.9.3.1.3 | Protocol in use | 0 | 1 | 0 | 2408 | Activates BACnet IP protocol |
| P5.9.3.1.4 | ForeignDevice | Sub menu for Foreign Device setting | | | | |
| P5.9.3.1.5.1 | ForeignDevice | No | Yes | No | 2555 | Activates foreign device registration |
| P5.9.3.1.5.2 | BBMD IP | | | 192.168.0.1 | 2409 | IP address of BBMD device to send registration |
| P5.9.3.1.5.3 | BBMD Port | 47808 | 47823 | 47808 | 2410 | BBMD port number |
| P5.9.3.1.5.4 | RegistrationInterval | 1 | 65535 | 10 | 2411 | Registration interval to keep a live connection to BBMD.<br>**NOTE!** Registration message TTL is twice as long as this time. |

*Table 10. Monitoring values*

| Code | Parameter | Min | Max | ID | Description |
|---|---|---|---|---|---|
| P5.9.3.2.1 | Fieldbus protocol status | INITIALIZING | INACTIVE | 2412 | See Table 12 |
| P5.9.3.2.2 | Communication status | 0.0 | 99.999 | 2413 | Counter for failed and good messages<br>failed msg's <-> good msg's |
| P5.9.3.2.3 | Actual instance | 0 | 4194304 | 2414 | Actual instance is use. In case instance parameter is zero you can see here generated instance number |
| P5.9.3.2.4 | Last fault | See fault codes (Table 11) | | 2556 | The fault code of the latest fault detected. |
| P5.9.3.2.5 | ActiveCOVcount | 0 | 20 | 2557 | Number of active COV subscriptions |

*Table 11. Fault Code values*

| Fault Number | Fault Text | Description |
|---|---|---|
| 0 | No fault | No fault detected since the last power-up. |
| 1 | Connection timeout | Timeout occurred in communication. |
| 2 | MAC address | Duplicate MAC address detected. |
| 3 | Autobaud Error | Error during baudrate detection. |
| 4 | Ethernet link lost | Ethernet cable disconnected during communication. |

*Table 12. Fieldbus Protocol Status*

| Value | Text | Description |
|---|---|---|
| 1 | INITIALIZING | Protocol is starting |
| 2 | STOPPED | Protocol is stopped |
| 3 | OPERATIONAL | Communicating |
| 4 | FAULTED | Timeout/APDU time expired |
| 5 | INACTIVE | No communication |



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## 4.3 BACNET MS/TP PARAMETER DESCRIPTIONS

### 4.3.1 BACNET MS/TP PARAMETERS

#### *P5.8.3.1.1 BAUD RATE*

Select the communication speed for the network. The default value is 9600 baud. If Autobauding is selected, the node will detect the baudrate. There must be at least one device in the bus to select the baud rate and to start token transmitting. When the baudrate is detected, it is saved into this parameter.

**NOTE!** Autobauding is disabled after baudrate is detected.

#### *P5.8.3.1.2 MAC ADDRESS*

The parameters of every device must be set before connecting to the bus. Especially the parameters *MAC address* and *Baud rate* must be the same as in the master's configuration.

The first parameter, BACnet MAC (Medium Access Control) address, must be unique on the network to which it is connected. The same MAC address may be used on a device on another network within the internetwork.

Addresses 128-254 are reserved for slaves. Addresses 1-127 are valid for both masters and slaves. The portion of the address space that is actually used for masters in a particular installation is determined by the value of the Max_Master property of the Device object.

It is recommended that MAC address 0 be reserved for use by the MS/TP router. 255 is reserved for broadcasts.

#### *P5.8.3.1.3 INSTANCE NUMBER*

The Device Object's Instance number must be unique across the entire BACnet internetwork because it is used to uniquely identify the BACnet devices. It may be used to conveniently identify the BACnet device from other devices during installation.

If 0 (default) is selected, the Device Instance number is generated from the last 22 bit of the Ethernet MAC address. This unique number is then shown in the Monitor menu (actual instance).

#### *P5.8.3.1.4 MAXMASTER*

This parameter defines the last possible master on the network segment. Each master node is responsible for searching new devices from network using the 'poll for master' messages. The nodes are searched up to MAC address defined by MaxMaster parameter.

This parameter affects the cycle time of the token. We recommend to use the highest MAC address value in the network for this parameter.

#### *P5.8.3.1.5 COMMUNICATION TIMEOUT*

The BACnet MS/TP indicates timeout error if the node is not receiving a token within time defined by this parameter. It can be used to detect communication loss to other nodes. Time unit is seconds.

**NOTE!** Application parameter P3.9.1.6 (ID 733) can be use to define action for communication timeout.

#### P5.8.3.1.6 MAXAPDUCYCLE

This parameter defines the maximum time in seconds between APDU messages addressed to this node. The APDU messages are Application layer messages, for example, 'ReadParameter' and 'Write Parameter' messages. This can be used to detect communication loss to the controlling node.

**NOTE!** The application parameter P3.9.1.6 (ID 733) can be used to define the action for communication timeout.

### 4.3.2 BACNET MS/TP MONITORING VALUES

#### P5.8.3.2.1 FIELDBUS PROTOCOL STATUS

*Fieldbus Protocol Status* tells the status of the protocol.

#### P5.8.3.2.2 COMMUNICATION STATUS

The *Communication status* shows how many error and how many good messages the AC drive has received. The Communication status includes a common error counter that counts CRC and parity errors and a counter for good messages.

Only messages to the current slave in use are counted in the good messages, not MS/TP token packages.

*Table 13.*

| Good messages | |
|---|---|
| 0...999 | Number of messages received without errors |
| **Bad Frames** | |
| 0...99 | Number of messages received with errors |

#### P5.8.3.2.3 ACTUAL INSTANCE NUMBER

Shows the actual instance number.

#### P5.8.3.2.4 LAST FAULT

This monitor value consist of text string that gives extra information about the fault condition. Can be used to track the reason for communication timeout. See Table 11.

#### P5.8.3.2.5 UARTDBG

This is advanced debug information from RS-485 uart module. It shows parity, framing and overrun errors occurred while receiving the MSTP messages.

#### P5.8.3.2.6 ACTIVECOVCOUNT

This shows the number of active COV subscriptions on the device.



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## 4.4 BACnet IP parameter descriptions

### 4.4.1 Ethernet common settings

#### *P5.9.1.1 IP address mode*

Selectable alternatives are *DHCP* (Dynamic Host Configuration Protocol) and *Fixed*.

DHCP protocol gives IP addresses to new devices connecting to local network. This address is valid for a certain period of time.

A fixed IP address is specified manually and it does not change.

If the fixed IP mode is selected, the addresses defined in the 'Fixed IP' menu come into use. The default Fixed IP is shown below.

*IP*: 192.168.0.10
*Subnet mask*: 255.255.0.0
*Default gateway*: 0.0.0.0

#### *P5.9.1.3 IP address*

An *IP address* is a series of numbers (like above) specific to the device connected to the Internet.

#### *P5.9.1.4 Subnet mask*

The network mask marks all the bits of an IP address for the identification of the network and the subnetwork.

#### *P5.9.1.5 Default gateway*

Gateway address is the IP address of a network point that acts as an entrance to another network. This needs to be defined if the device communicates with nodes on different networks, for example, if the 'Foreign Device' functionality is active.

#### *P5.9.1.6 MAC address*

The Ethernet MAC address of the control board.

MAC address (Media Access Control) is a unique address given to each network host.

### 4.4.2 BACNET IP SETTINGS

#### *P5.9.3.1.1 INSTANCE NUMBER*

Similar to BACnet MS/TP device object instance number (see Chapter 4.3.1).

#### *P5.9.3.1.2 BACNET PORT NUMBER*

The UDP port for the BACnet IP communication.

#### *P5.9.3.1.3 COMMUNICATION TIME-OUT*

Defines the number of seconds after a timeout is indicated after a communication break or disconnected ethernet link. Value 0 disables communication and link supervision.

**NOTE!** The Application parameter P3.9.1.6 (ID 733) can be used to define the action for communication timeout.

#### *P5.9.3.1.4 PROTOCOL IN USE*

BACnet/IP protocol can be enabled and disabled with this parameter. When the parameter value is set to "**1**" the BACnet/IP protocol is enabled and disabled when set to "**0**".

#### *P5.9.3.1.5 FOREIGNDEVICE*

The foreign device settings are located under this submenu. The foreign device feature is used when the device is located in a different network than the BBMD. A normal router does not send broadcast messages between different networks. The 'Foreign device' feature solves this problem by establishing a connection to the BBMD with unicast messages. All broadcast messages are forwarded to a BBMD device that takes care of receiving and transmitting broadcast messages in both directions for all foreign devices.

#### *P5.9.3.1.5.1 FOREIGNDEVICE*

If this parameter is set to value 'Yes', the foreign device registration becomes active.

#### *P5.9.3.1.5.2 BBMD IP*

The IP address of the BACnet IP Broadcast Management Device.

#### *P5.9.3.1.5.3 BBMD PORT*

The BBMD Port number.

#### *P5.9.3.1.5.4 REGISTRATIONINTERVAL*

The registration interval to keep a live connection to the BBMD. Unit is seconds.

**NOTE!** The Registration TTL is twice as long as this time.



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### 4.4.3 BACNET IP MONITORING VALUES

#### *P5.9.3.2.1 FIELDBUS PROTOCOL STATUS*

Fieldbus Protocol Status tells the status of the protocol.

#### *P5.9.3.2.2 COMMUNICATION STATUS*

The Communication status shows how many error and how many good messages the AC drive has received. The Communication status includes a common error counter that counts CRC and parity errors and a counter for good messages.

*Table 14.*

| **Good messages** | |
|---|---|
| 0...999 | Number of messages received without errors |
| **Bad Frames** | |
| 0...99 | Number of messages received with errors |

#### *P5.9.3.2.3 ACTUAL INSTANCE NUMBER*

The Device Object's actual instance number. This monitoring value is needed when value 0 is written to parameter P5.8.3.1.1.

#### *P5.9.3.2.4 LAST FAULT*

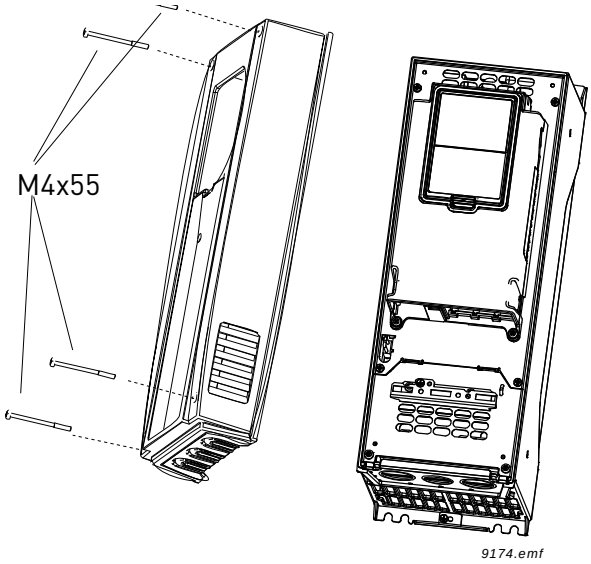
This monitor value contains a text string that gives extra information about the fault condition. Can be used to track reason for communication timeout. See Table 11.

#### *P5.9.3.2.5 ACTIVECOVCOUNT*

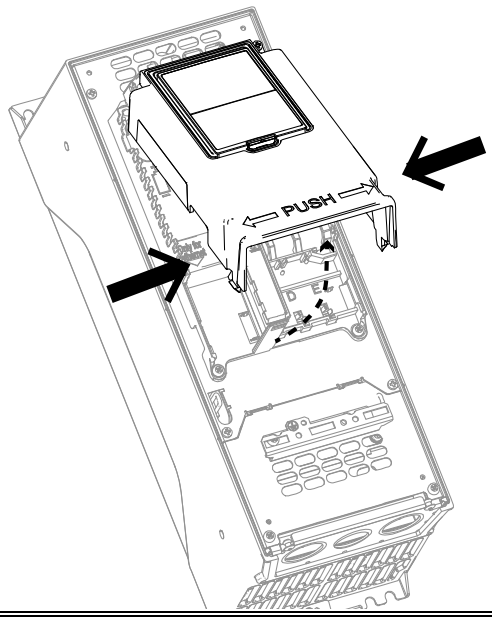
This shows the number of active COV subscriptions on the device.

# 5. INSTALLATION

## 5.1 VACON® 100

| | |
|---|---|
| 1 | Open the cover of the AC drive.<br>  <br><br>9174.emf |

The relay outputs and other I/O-terminals may have a dangerous control voltage present even when the AC drive is disconnected from mains.

| | |
|---|---|
| 2 | Open the inner cover of the drive.<br>  <br> |



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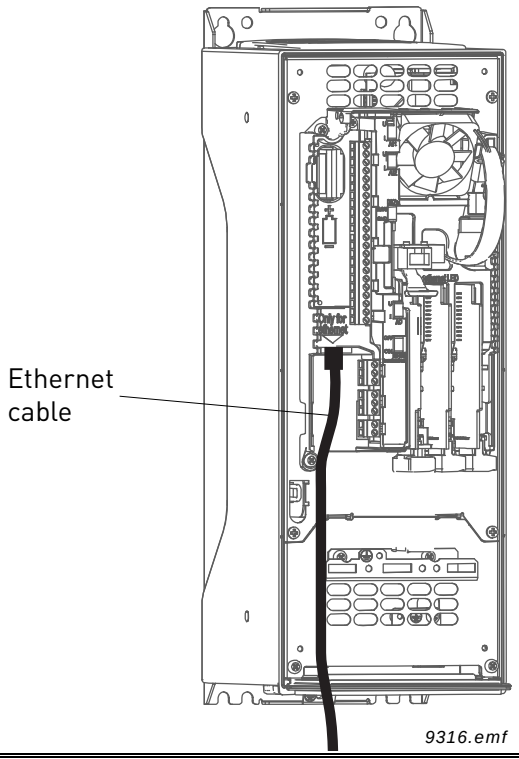
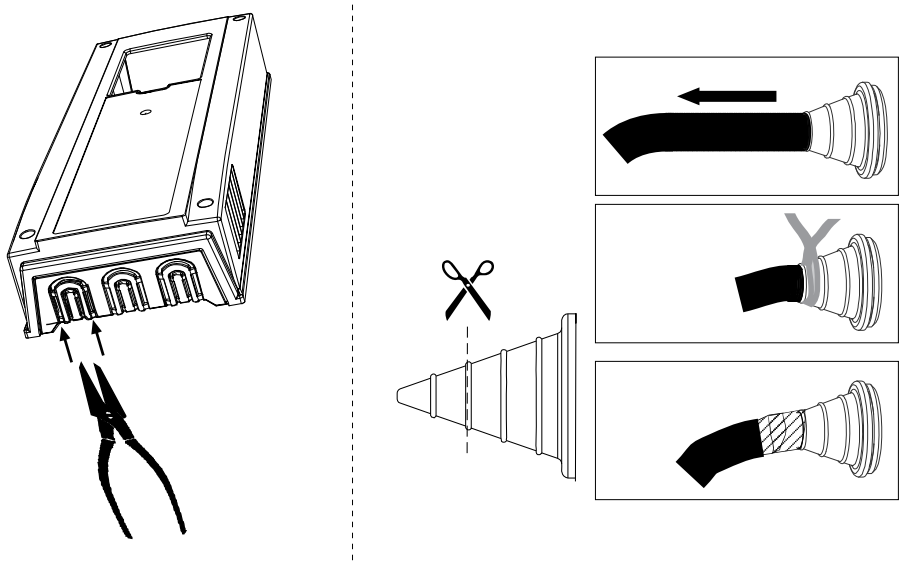
### 5.1.1 PREPARE FOR USE THROUGH ETHERNET

| | |
|---|---|
| 3 | Connect the Ethernet cable (see specification in Chapter 3.2) to its terminal as shown in figure below.   |

| | |
|---|---|
| **4** | **Protection class IP21:** Cut free the opening on the AC drive cover for the Ethernet cable.<br>**Protection class IP54:** Cut the rubber grommets open to slide the cables through. Should the grommets fold in while inserting the cable, just draw the cable back a bit to straighten the grommets up. Do not cut the grommet openings wider than what is necessary for the cables you are using.<br>**NOTE!** To meet the requirements of the enclosure class IP54, the connection between the grommet and the cable must be tight. Therefore, lead the first bit of the cable out of the grommet **straight** before letting it bend. If this is not possible, the tightness of the connection must be ensured with insulation tape or a cable tie.<br>  <br>9068.emf |



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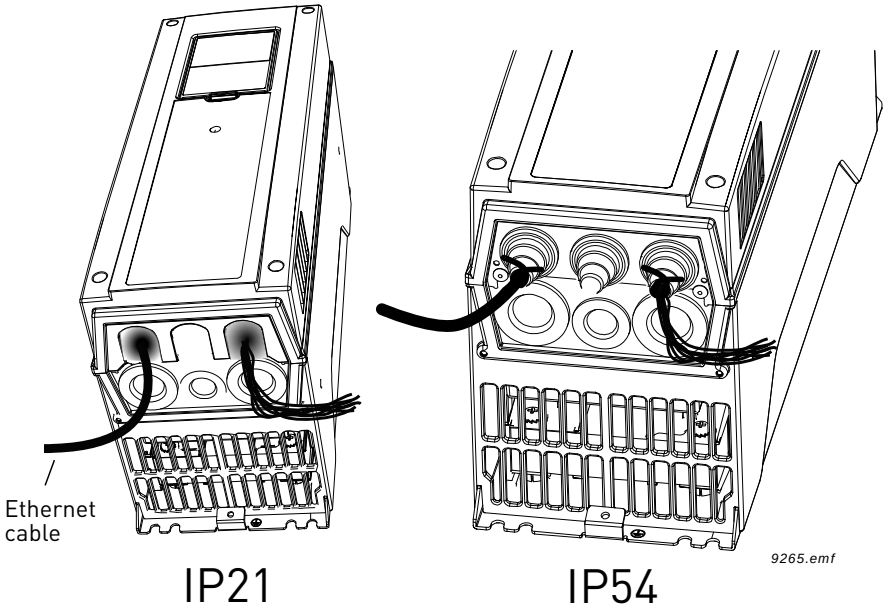
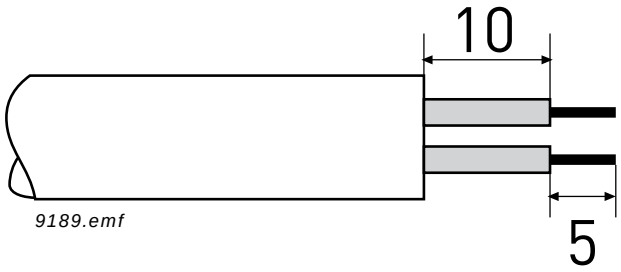
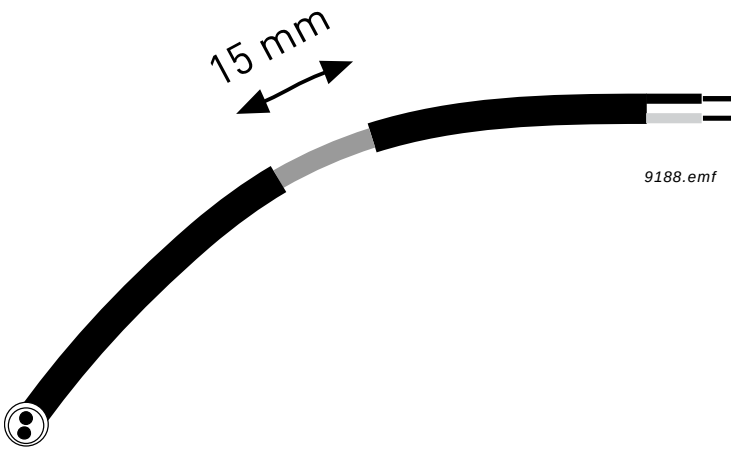
| | |
|---|---|
| **5** | Remount the AC drive cover.<br>**NOTE!** When planning the cable runs, remember to keep the distance between the Ethernet cable and the motor cable at a **minimum of 30 cm**.<br>  <br> |

### 5.1.2 PREPARE FOR USE THROUGH RS485

| | |
|---|---|
| 1 | Strip about 15 mm of the RS485 cable (see specification in Chapter 3.1) and cut off the grey cable shield. Remember to do this for both bus cables (except for the last device).<br>Leave no more than 10 mm of the cable outside the terminal block and strip the cables at about 5 mm to fit in the terminals. See picture below.<br>  <br>Also strip the cable now at such a distance from the terminal that you can fix it to the frame with the grounding clamp. Strip the cable at a maximum length of 15 mm. **Do not strip the aluminum cable shield!**<br>  |



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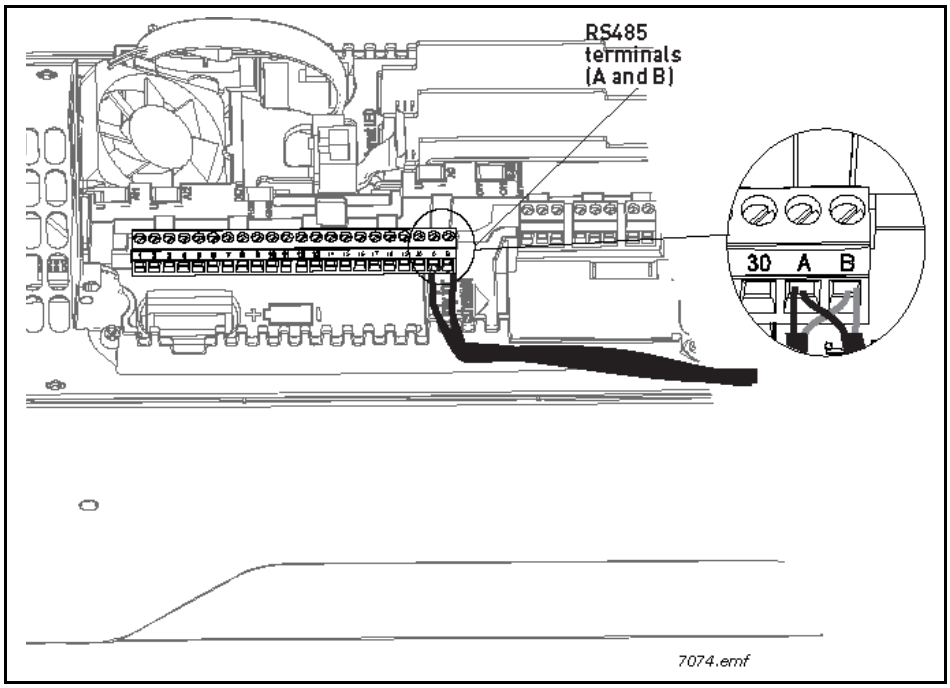
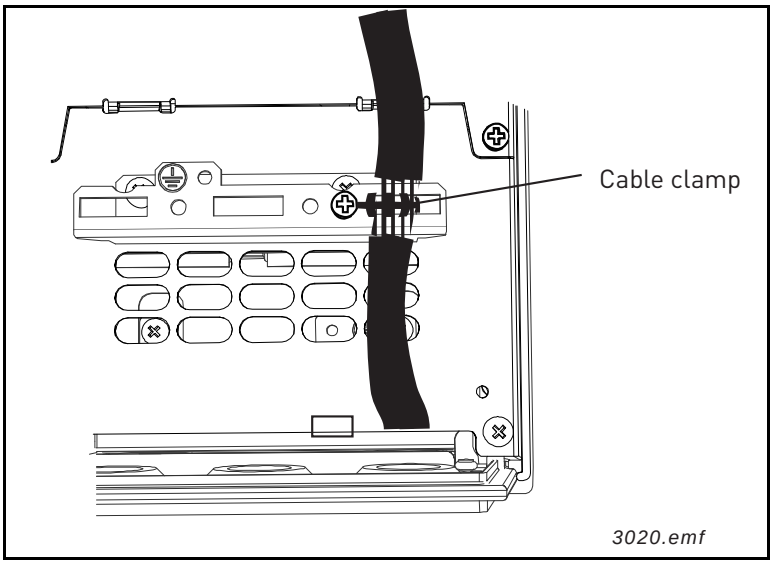
| | |
|---|---|
| **2** | Then connect the cable to its appropriate terminals on Vacon 100 drive standard terminal block, terminals **A and B** (A = negative, B = positive). See figure below. |

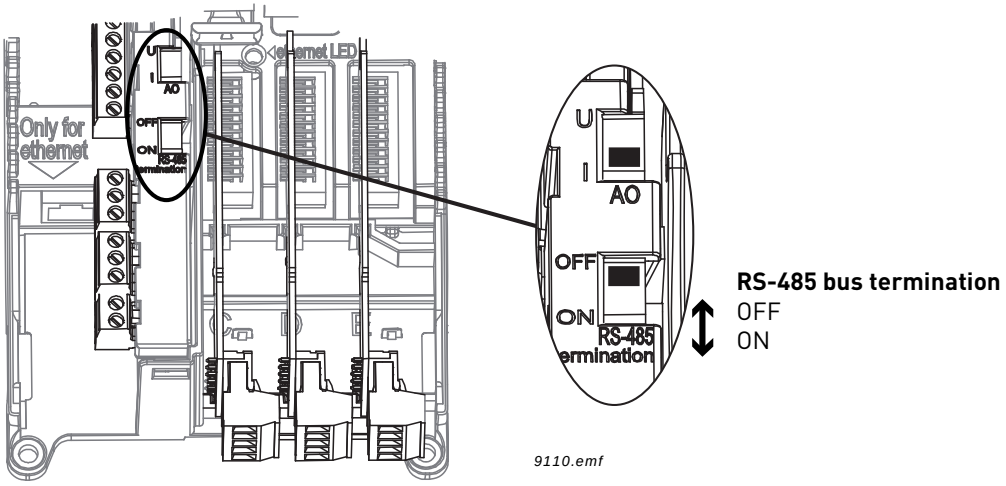



| | |
|---|---|
| **3** | Using the cable clamp included in the delivery of the drive, ground the shield of the RS485 cable to the frame of the AC drive.<br>**NOTE!** This can be done in all drives if there is no difference in PE potentialbe-tween the drives. However, if there is PE potential difference then the shield-should be connected to PE only at one point in the system. The shields of thecables shall be joint but not connected to several PE points with different poten-tial.<br>**NOTE!** This is only a principle drawing and the actual drive may look different. |



**4**

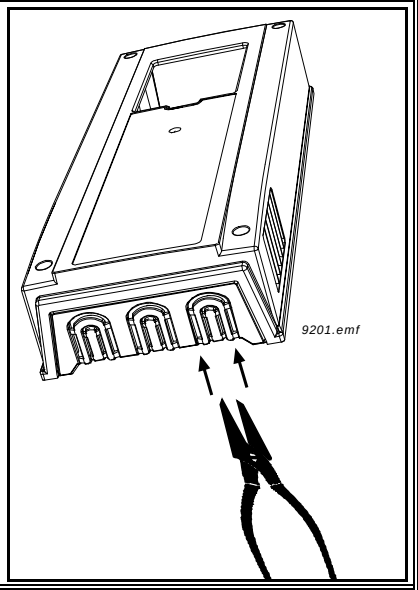
**If Vacon 100 is the last device on the bus**, the bus termination must be set. Locate the DIP switches to the right of the control keypad of the drive and turn the switch for the RS485 bus termination resistor to position ON. Biasing is built in the termination resistor. See also step 6 on page 23.




**5**

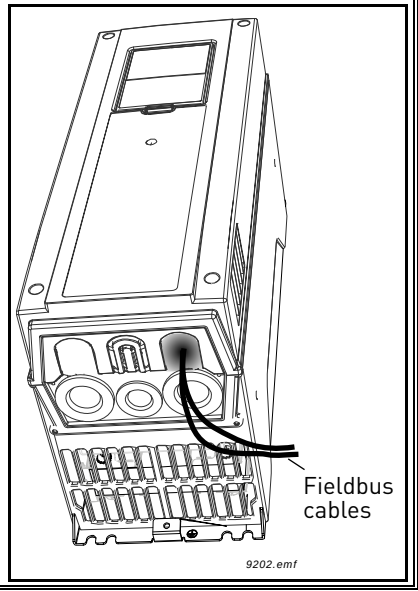
Unless already done for the other control cables, cut free the opening on the AC drive cover for the RS485 cable (protection class IP21).

**NOTE!** This is only a principle drawing and the actual drive may look different.




**6**

Remount the AC drive cover and run the RS485 cables as shown in picture.
**NOTE!** When planning the cable runs, remember to keep the distance between the fieldbus cable and the motor cable at a **minimum of 30 cm**.



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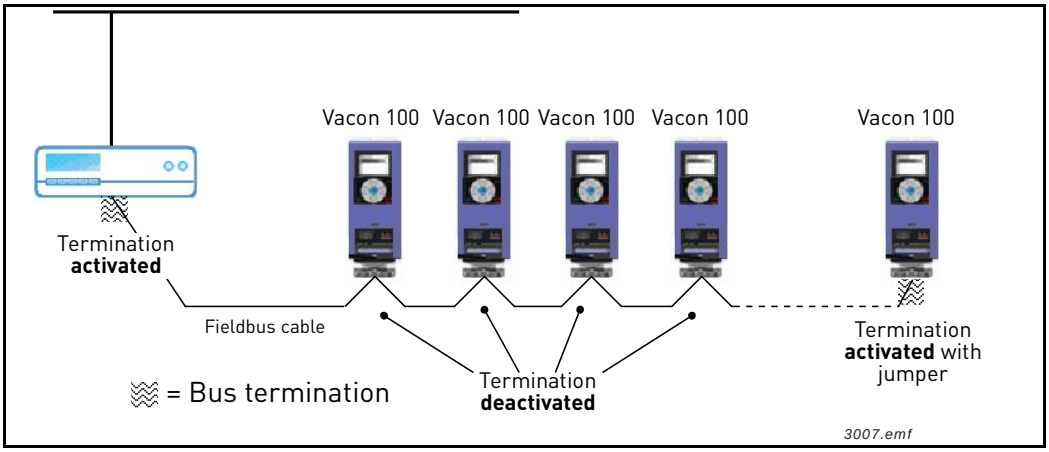
| | |
|---|---|
| **7** | The bus termination must be set for the first and the last device of the fieldbus line. See picture below. See also step 3 on page 22. It is recommended that the devices at the ends of the bus line have termination activated. |



## 5.2 INSTALLATION IN VACON® 100 X

The AC drive can be connected to fieldbus either through RS485 or Ethernet. The connection for RS485 is on the standard I/O terminals (A and B) and the connection for Ethernet is left to the control terminals.

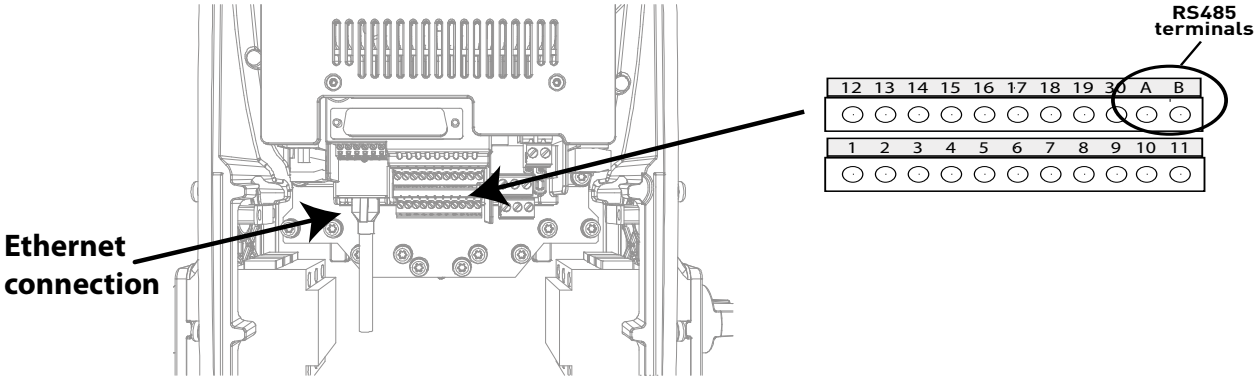



*Figure 2.*

### 5.2.1 PREPARE FOR USE THROUGH ETHERNET

| | |
|---|---|
| **1** | Connect the Ethernet cable (see specification in Chapter 3.2) to its terminal and run the cable through the conduit plate. |

| | |
|---|---|
| **2** | Remount the powerhead.<br>**NOTE:** When planning the cable runs, remember to keep the distance between the Ethernet cable and the motor cable at a minimum of 30 cm. |

For more detailed information, see the user's manual of the fieldbus you are using.



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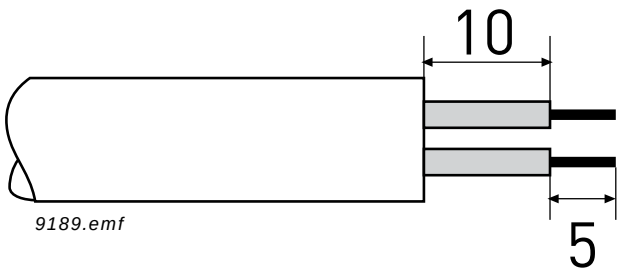
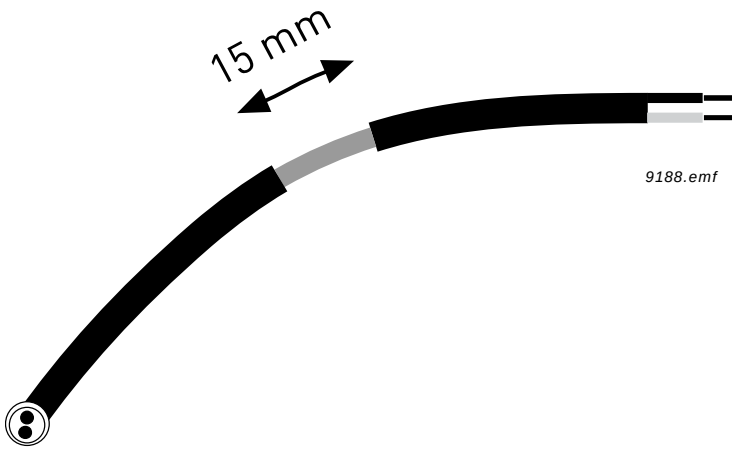
### 5.2.2 PREPARE FOR USE THROUGH RS485

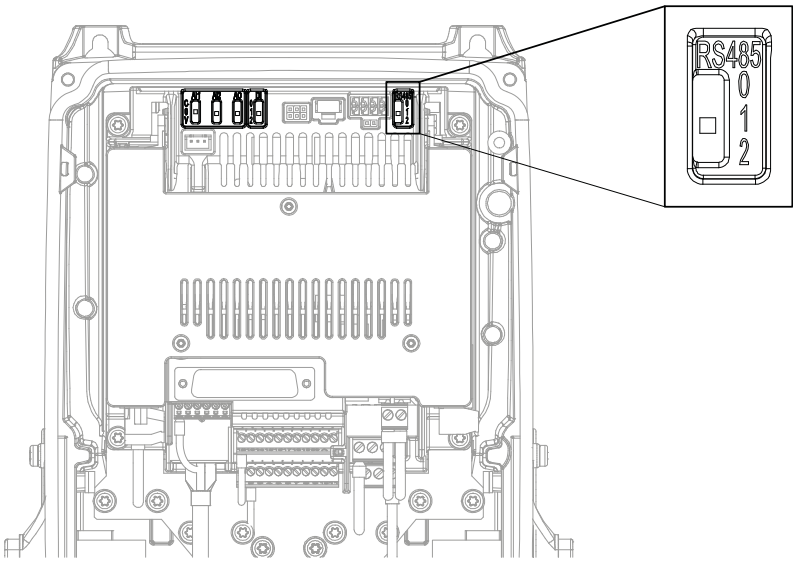
| | |
|---|---|
| 1 | Strip about 15 mm of the RS485 cable (see specification in Chapter 3.1) and cut off the grey cable shield. Remember to do this for both bus cables (except for the last device).<br>Leave no more than 10 mm of the cable outside the terminal block and strip the cables at about 5 mm to fit in the terminals. See picture below.<br>  <br><br>Also strip the cable now at such a distance from the terminal that you can fix it to the frame with the grounding clamp. Strip the cable at a maximum length of 15 mm. **Do not strip the aluminum cable shield!**<br>  <br> |

| | |
|---|---|
| 2 | Then connect the cable to its appropriate terminals on VACON® 100 X AC drive standard terminal block, terminals A and B (A = negative, B = positive). See Figure 2. |

| | |
|---|---|
| 3 | Using the cable clamp included in the delivery of the drive, ground the shield of the RS485 cable to the frame of the AC drive. |

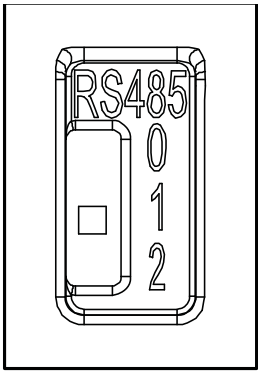
**4**

**If VACON® 100 X AC drive is the last device on the bus**, the bus termination must be set. Locate the DIP switches to the top of the control unit (see figure below).



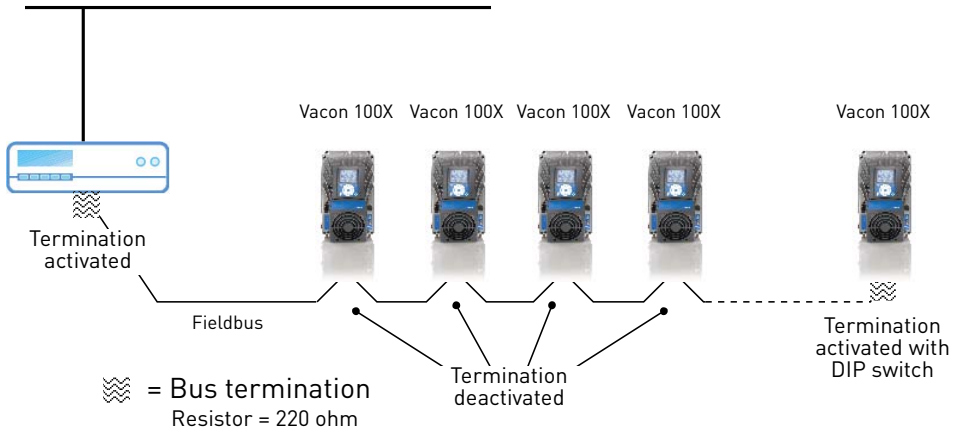

Turn the right most switch to position "1". Biasing is built in the termination resistor. See also step 6.

**NOTE:** When planning the cable runs, remember to keep the distance between the fieldbus cable and the motor cable at a **minimum of 30 cm**.




**5**

The bus termination must be set for the first and the last device of the fieldbus line. See picture below and step 4. We recommend that the first device on the bus and, thus, terminated, was the Master device.



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# 6. COMMUNICATIONS

## 6.1 OBJECT TYPES AND PROPERTIES SUPPORTED

*Table 15. Object types and properties supported*

| Property | Object Type | | |
|---|---|---|---|
| | **Device** | **Binary Value** | **Analogue Value** |
| Object_Identifier | X | X | X |
| Object_Name | X | X | X |
| Object_Type | X | X | X |
| System_Status | X | | |
| Vendor_Name | X | | |
| Vendor_Identifier | X | | |
| Model_Name | X | | |
| Firmware_Revision | X | | |
| Application_Software_Version | X | | |
| Description | | | |
| Protocol_Version | X | | |
| Protocol_Revision | X | | |
| Protocol_Services_Supported | X | | |
| Protocol_Object_Types_Supported | X | | |
| Object_List | X | | |
| Max_APDU_Length_Accepted | X | | |
| Segmentation_Supported | X | | |
| Max_Segments_Accepted | X | | |
| Local_Time | X | | |
| Local_Date | X | | |
| UTC_Offset | X | | |
| Daylight_Savings_Status | X | | |
| APDU_Segment_Timeout | X | | |
| APDU_Timeout | X | | |
| Number_Of_APDU_Retries | X | | |
| Max_Master | X | | |
| Max_Info_Frames | X | | |
| Device_Address_Binding | X | | |
| Database_Revision | X | | |
| Active_COV_Subscriptions | X | | |
| Event_State | | X | X |
| Out_Of_Service | | X | X |
| Present_Value | | X | X |
| Priority_Array | | X * | X * |
| Relinquish_Default | | X * | X * |
| Status_Flags | | X | X |
| COV_Increment | | | X |
| Units | | | X |

*. Only with commandable values

### 6.1.1 BINARY VALUE OBJECT

*Table 16.*

| Instance ID | Object Name | Description | Inactive / Active | Present Value Access Type |
|---|---|---|---|---|
| *BV0* | Ready State | Indicates whether the drive is ready or not | Not Ready / Ready | R |
| *BV1* | Run/Stop State | Indicates whether the drive is running or stopped | Stop / Run | R |
| *BV2* | Fwd/Rev State | Indicates the rotation direction of the motor | Fwd / Rev | R |
| *BV3* | Fault State | Indicates if a fault is active | OK / Fault | R |
| *BV4* | Alarm State | Indicates if an alarm is active | OK / Alarm | R |
| *BV5* | At Setpoint | Ref. Frequency reached | False / True | R |
| *BV6* | At Zero Speed | Motor Running at zero speed | False / True | R |
| *BV7* | fb_ProcessdataOut_01 Bit_0 | ProcessDataOut1 bit 0 | 0 / 1 | R |
| *BV8* | fb_ProcessdataOut_01 Bit_1 | ProcessDataOut1 bit 1 | 0 / 1 | R |
| *BV9* | fb_ProcessdataOut_01 Bit_2 | ProcessDataOut1 bit 2 | 0 / 1 | R |
| *BV10* | fb_ProcessdataOut_01 Bit_3 | ProcessDataOut1 bit 3 | 0 / 1 | R |
| *BV11* | fb_ProcessdataOut_01 Bit_4 | ProcessDataOut1 bit 4 | 0 / 1 | R |
| *BV12* | fb_ProcessdataOut_01 Bit_5 | ProcessDataOut1 bit 5 | 0 / 1 | R |
| *BV13* | fb_ProcessdataOut_01 Bit_6 | ProcessDataOut1 bit 6 | 0 / 1 | R |
| *BV14* | fb_ProcessdataOut_01 Bit_7 | ProcessDataOut1 bit 7 | 0 / 1 | R |
| *BV15* | Run/Stop CMD | Command to start drive (FB control is active) | Stop / Run | C |
| *BV16* | Fwd/Rev CMD | Command to run forward/ reverse | Fwd/Rev | C |
| *BV17* | Reset Fault | Command to reset Active Fault from drive | 0 / Reset | C |
| *BV18* | Stop By Coast | Stop Drive by coast | 0 / 1 | C |
| *BV19* | Stop By Ramp | Stop Drive by ramp | 0 / 1 | C |
| *BV20* | Quick Stop | Quick Stop | 0 / 1 | C |
| *BV21* | Zero Ramp | Stop by zero ramp | 0 / 1 | C |
| *BV22* | Hold Ramp | Hold ramp | 0 / 1 | C |
| *BV23* | BusCtrl | Activate Bus control | 0 / 1 | C |
| *BV24* | BusRef | Activate Bus reference | 0 / 1 | C |
| *BV25* | fb_control_word Bit_10 | fb_control_word bit 10 | 0 / 1 | C |
| *BV26* | fb_control_word Bit_11 | fb_control_word bit 11 | 0 / 1 | C |
| *BV27* | fb_control_word Bit_12 | fb_control_word bit 12 | 0 / 1 | C |



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*Table 16.*

| | | | | |
|---|---|---|---|---|
| *BV28* | fb_control_word Bit_13 | fb_control_word bit 13 | 0 / 1 | C |
| *BV29* | fb_control_word Bit_14 | fb_control_word bit 14 | 0 / 1 | C |
| *BV30* | fb_control_word Bit_15 | fb_control_word bit 15 | 0 / 1 | C |

**NOTE!** Present Value Access Types: **R** = Read-only, **W** = Writeable, **C** = Commandable. Commandable values support priority arrays & relinquish defaults.

### 6.1.2 ANALOGUE VALUE OBJECT

*Table 17.*

| Instance ID | Object Name | Description | Units | Present Value Access Type |
|---|---|---|---|---|
| *AV0* | Frequency Setpoint | Frequency Setpoint | Hz | R |
| *AV1* | Output Frequency | Output Frequency | Hz | R |
| *AV2* | Motor Speed | Motor Speed | rpm | R |
| *AV3* | Load (power) | Motor Shaft Power | % | R |
| *AV4* | Kilowatt Hours total | Kilowatt Hour Counter (Total) | kWh | R |
| *AV5* | Motor Current | Motor Current | A | R |
| *AV6* | DC link Voltage | DC link Voltage | V | R |
| *AV7* | Motor Voltage | Motor Voltage | V | R |
| *AV8* | Unit Temperature | Heatsink Temperature | °C | R |
| *AV9* | Motor Torque | In % of motor nominal Torque | % | R |
| *AV10* | Operating Days | Operating Days (resettable) | Day | R |
| *AV11* | Operating Hours | Operating Hours (resettable) | Hour | R |
| *AV12* | Kilowatt Hours | Kilowatt Hours (resettable) | kWh | R |
| *AV13* | Torque Reference | Torque Reference | % | R |
| *AV14* | Temperature Rise | Calculated motor temperature 100,0% = nominal temperature of motor | % | R |
| *AV15* | fb_ProcessdataOut_01 | Application specific [2)] | | R |
| *AV16* | fb_ProcessdataOut_02 | Application specific [2)] | | R |
| *AV17* | fb_ProcessdataOut_03 | Application specific [2)] | | R |
| *AV18* | fb_ProcessdataOut_04 | Application specific [2)] | | R |
| *AV19* | fb_ProcessdataOut_05 | Application specific [2)] | | R |
| *AV20* | fb_ProcessdataOut_06 | Application specific [2)] | | R |

*Table 17.*

| | | | | |
|---|---|---|---|---|
| *AV21* | fb_ProcessdataOut_07 | Application specific 2) | | R |
| *AV22* | fb_ProcessdataOut_08 | Application specific 2) | | R |
| *AV23* | Active Fault Code | Active Fault Code | - | R |
| *AV24* | Speed Reference | Speed Reference, percentage of nominal speed | % | C |
| *AV25* | Current Limit | Current Limit | A | W |
| *AV26* | Min Frequency | Minimum Frequency | Hz | W |
| *AV27* | Maximum Frequency | Maximum Frequency | Hz | W |
| *AV28* | Accel Time | Acceleration Time | s | W |
| *AV29* | Decel Time | Deceleration Time | s | W |
| *AV30* | fb_ProcessdataIn_01 | Application specific 2) | | C |
| *AV31* | fb_ProcessdataIn_02 | Application specific 2) | | C |
| *AV32* | fb_ProcessdataIn_03 | Application specific 2) | | C |
| *AV33* | fb_ProcessdataIn_04 | Application specific 2) | | C |
| *AV34* | AnyParam ID | ID number that is used in AV35 | 0 to 65535 resolution 1 | W |
| *AV35* | AnyParam Value | Value of ID defined by AV34 | 32 bits Value | W |
| *AV36 1)* | Fb_Control_Word Lo16 | Fixed Control Word First 16 bits 0-15 | range 65535 - 0 | C |
| *AV37 1)* | Fb_Control_Word Hi16 | Fixed Control Word Last 16 bits 16-31 | range 65535 - 0 | C |
| *AV38* | Fb_Status_Word Lo16 | Fixed Status Word First 16 bits 0-15 | range 65535 - 0 | R |
| *AV39* | Fb_Status_Word Hi16 | Fixed Status Word Last 16 bits 16-31 | range 65535 - 0 | R |

1) ANSI/IEEE-754 floating point. Binary coding can be done only if the value has no decimals.
2) Map only analog data to these objects. If binary coded data is mapped into these objects, the data may be invalid because of ANSI/IEEE-754 floating point to 32bit integer conversion.

**NOTE!** Present Value Access Types: **R** = Read-only, **W** = Writeable, **C** = Commandable. Commandable values support priority arrays & relinquish defaults.

High and Low limits for the objects are defined in the application. See corresponding application for exact limits.



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## 6.2 CONTROL WORD BITS

*Table 18. Control Word bits*

| Bit | Name | Value = 1 | Value = 0 | Description |
|---|---|---|---|---|
| B0 | Start/Stop | Start request | Stop request | Start/Stop command to application |
| B1 | Fwd/Rev | Reverse direction | Forward direction | Controls the direction of motor axis rotation |
| B2 | Fault reset | Reset faults | No action | Command to reset fault |
| B3-B15 | Not used | | | |

## 6.3 STATUS WORD BITS

*Table 19. Status Word bits*

| Bit | Name | Value = 1 | Value = 0 | Description |
|---|---|---|---|---|
| B0 | Ready | Ready | Not ready | Indicates whether the drive is ready or not |
| B1 | Run | Running | Stop | Indicates whether the drive is running or stopped |
| B2 | Direction | Counterclockwise | Clockwise | Indicates the rotation direction of the motor |
| B3 | Fault | Faulted | Not faulted | Indicates if a fault is active |
| B4 | Alarm | Alarm | No alarm | Indicates if an alarm is active |
| B5 | AtReference | True | False | Reference frequency reached |
| B6 | ZeroSpeed | True | False | Motor running at zero speed |
| B7-B15 | Not used | | | |

# 7. FAULT TRACING

When an unusual operating condition is detected by the AC drive control diagnostics, the drive initiates a notification visible, for example, on the keypad. The keypad will show the ordinal number of the fault, the fault code and a short fault description.

The fault can be reset with the Reset button on the control keypad or via the I/O terminal. The faults are stored in the Fault history menu, which can be browsed. The different fault codes you will find in the table below. This fault table presents only the faults related to the fieldbus in use.

**NOTE!** When contacting distributor or factory because of a fault condition, always write down all texts and codes on the keypad display and send a description of the problem together with the *Drive Info File* to tech.supportVDF@vacon.com.

## 7.1 TYPICAL FAULT CONDITIONS

*Table 20. Typical fault conditions*

| Fault condition | Possible cause | Remedy |
|---|---|---|
| Termination resistor | Missing or excessive termination resistor. | Install termination resistors at both ends of the fieldbus line. |
| Cabling | • Supply or motor cables are located too close to the fieldbus cable<br>• Wrong type of fieldbus cable<br>• Too long cabling | |
| Grounding | Inadequate grounding. | Ensure grounding in all points on the net |
| Connections | Faulty connections:<br>• Excessive stripping of cables<br>• Conductors in wrong terminals<br>• Too loose connections of conductors | |
| Parameter | • Faulty address<br>• Overlapping slave addresses<br>• Wrong baud rate<br>• Wrong control place selected | |



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## 7.2 OTHER FAULT CONDITIONS

The following fault tracing diagram will help you to locate and fix some of the most usual problems. If the problem persists contact your local distributor.

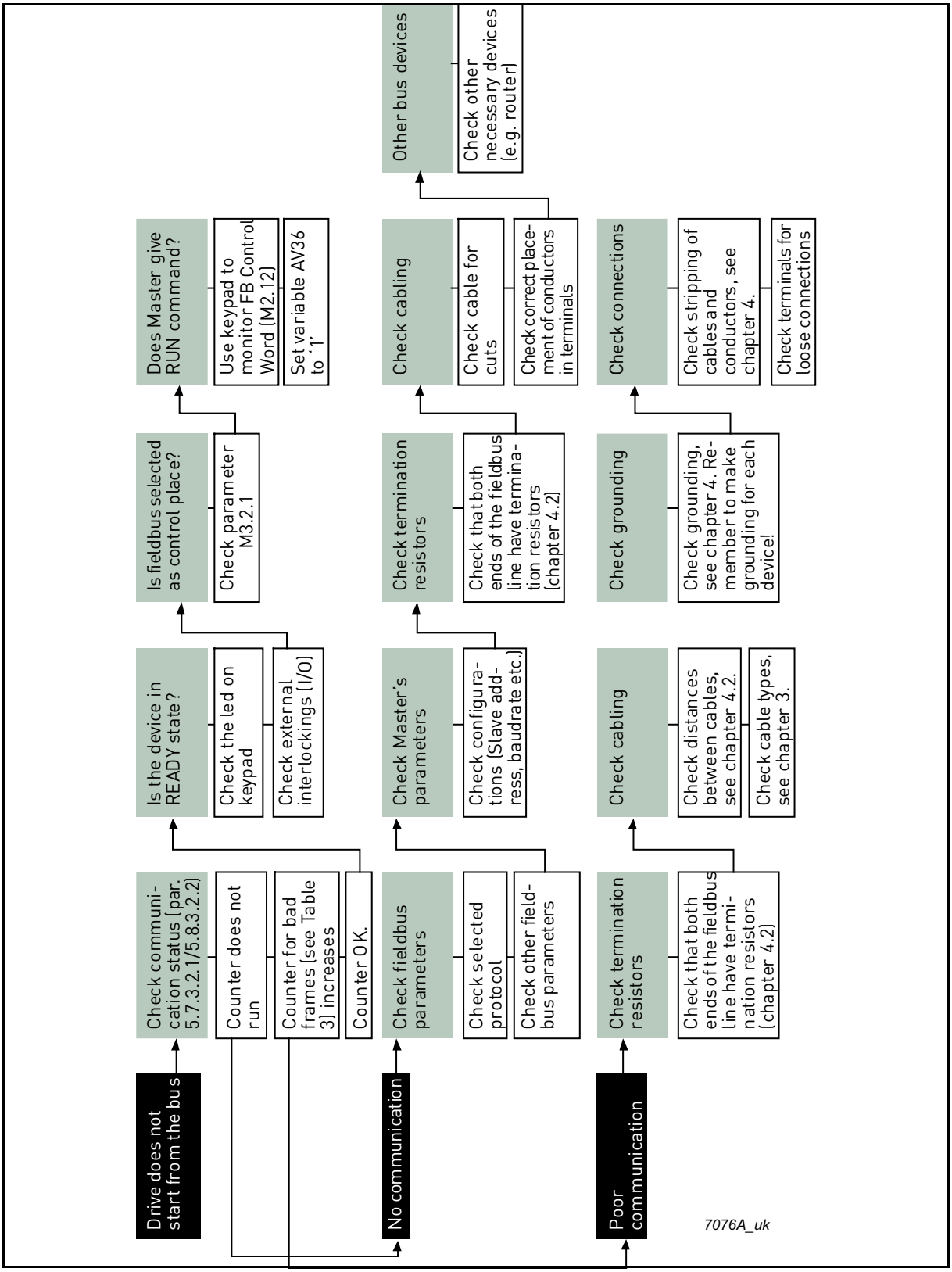
Drive does not start from the bus
Check communication status (par. 5.7.3.2.1/5.8.3.2.2)
Counter does not run
Counter for bad frames (see Table 3) increases
Counter OK.
Is the device in READY state?
Check the led on keypad
Check external interlockings (I/O)
Does Master give RUN command?
Use keypad to monitor FB Control Word (M2.12)
Set variable AV36 to '1'
No communication
Check fieldbus parameters
Check selected protocol
Check other fieldbus parameters
Check Master's parameters
Check configurations (Slave address, baudrate etc.)
Is fieldbus selected as control place?
Check parameter M3.2.1
Other bus devices
Check other necessary devices (e.g. router)
Poor communication
Check termination resistors
Check that both ends of the fieldbus line have termination resistors (chapter 4.2)
Check cabling
Check cable for cuts
Check correct placement of conductors in terminals
Check termination resistors
Check that both ends of the fieldbus line have termination resistors (chapter 4.2)
Check cabling
Check distances between cables, see chapter 4.2.
Check cable types, see chapter 3.
Check grounding
Check grounding, see chapter 4. Remember to make grounding for each device!
Check connections
Check stripping of cables and conductors, see chapter 4.
Check terminals for loose connections
7076A_uk

*Figure 3. Fault tracing diagram for BACnet MS/TP*

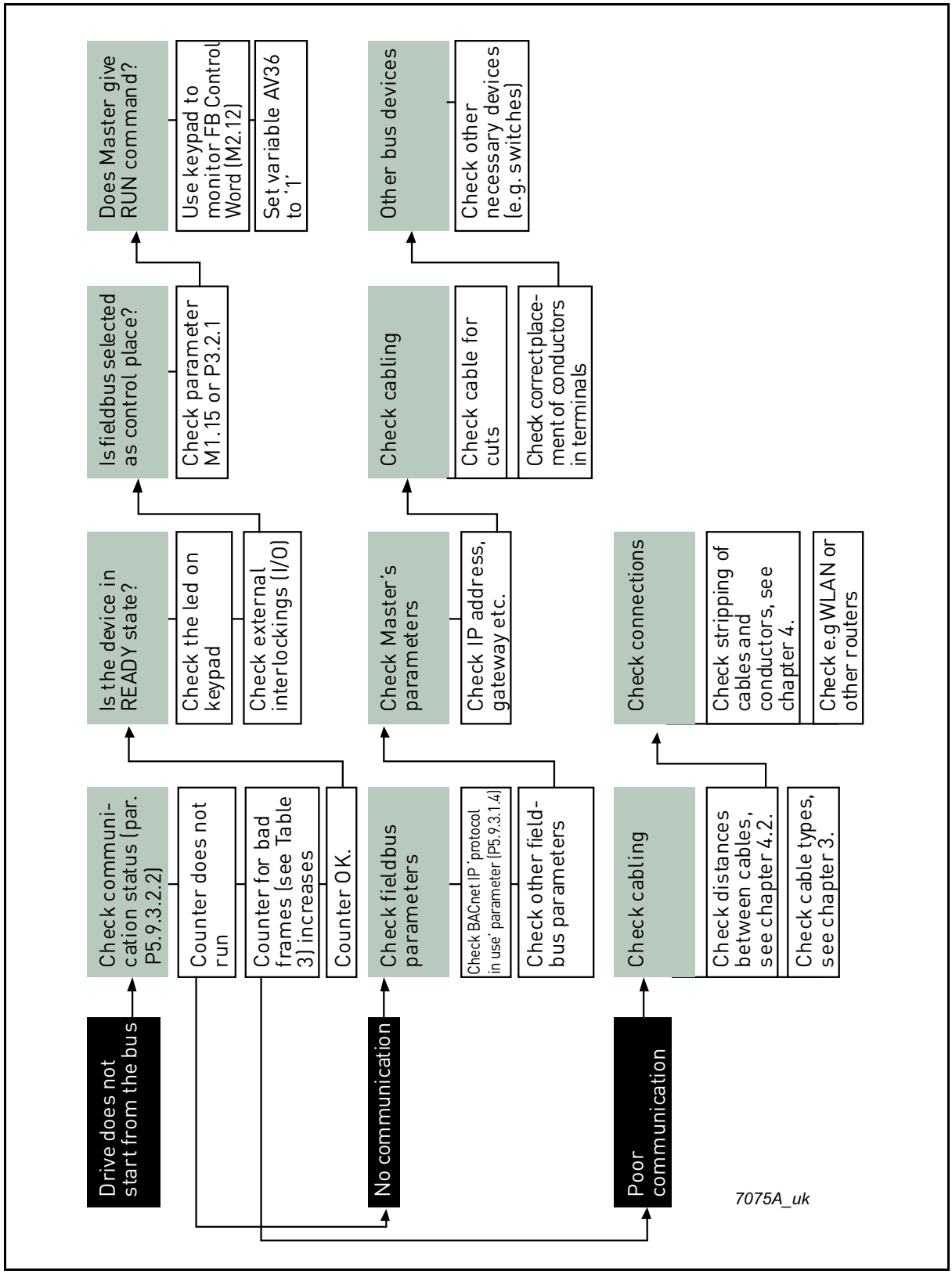
Drive does not start from the bus
Check communi-cation status (par. P5.9.3.2.2)
Counter does not run
Counter for bad frames (see Table 3) increases
Counter OK.
Is the device in READY state?
Check the led on keypad
Check external interlockings (I/O)
Does Master give RUN command?
Use keypad to monitor FB Control Word (M2.12)
Set variable AV36 to '1'
No communication
Check fieldbus parameters
Check BACnet IP 'protocol in use' parameter (P5.9.3.1.4)
Check other field-bus parameters
Is fieldbus selected as control place?
Check parameter M1.15 or P3.2.1
Check Master's parameters
Check IP address, gateway etc.
Check cabling
Check cable for cuts
Check correct place-ment of conductors in terminals
Poor communication
Check cabling
Check distances between cables, see chapter 4.2.
Check cable types, see chapter 3.
Check connections
Check stripping of cables and conductors, see chapter 4.
Check e.g WLAN or other routers
Other bus devices
Check other necessary devices (e.g. switches)
7075A_uk

*Figure 4. Fault tracing diagram for BACnet IP*



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# 8. QUICK SETUP

Following these instructions, you can easily and fast set up your BACnet bus for use.

| | |
|---|---|
| **1** | Choose control place.<br>A. To select *Remote Control Place*, press LOC/REM button on the keypad on Vacon 100 HVAC, and FUNCT button on Vacon 100 and Vacon 100 FLOW.<br>B. Select *Fieldbus* as remote control place: *Main Menu > Parameters (M3) > Start/Stop Setup (M3.2) > Rem. Ctrl. Place (P3.2.1)*. |
| **2** | Make these settings in the master software.<br>A. Set *Control Word* to **'0'** (AV36 Fb_Control_Word_Lo16).<br>B. Set *Control Word* to **'1'** (AV36 Fb_Control_Word_Lo16).<br>C. AC drive status is RUN.<br>D. Set Reference value to **'50'** (50.00%) (AV24 Speed Reference).<br>E. *Frequency setpoint* is **25.00 Hz** (if MinFreq is 0.00 Hz and MaxFreq is 50.00 Hz)<br>F. Set *Control Word* to '**0'** (AV36 Fb_Control_Word_Lo16).<br>G. AC drive status is STOP. |

# 9. ANNEX - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

**PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)**

(This annex is part of this Standard and is required for its use.)

**BACnet Protocol Implementation Conformance Statement**

**Date:** December 17, 2014

**Vendor Name:** Vacon

**Product Name:** Vacon 100

**Product Model Number:** Vacon 100, Vacon 100 X, Vacon FLOW

**Applications Software Version:** 1.0

**Firmware Revision:** 1.0

**BACnet Protocol Revision:** 12

**Product Description:** Vacon 100 Variable Frequency Drive (VFD) product range contains the following models based on the same software: Vacon 100, Vacon 100 FLOW, Vacon 100 X

**BACnet Standardized Device Profile (Annex L):** BACnet Application Specific Controller (B-ASC)

**List all BACnet Interoperability Building Blocks Supported (Annex K):** DS-RP-B, DS-RPM-B, DS-WP-B, DS-WPM-B, DS-COV-B, DM-TS-B, DM-UTC-B, DM-RD-B, DM-DDB-B, DM-DOB-B, DM-DCC-B.

**Segmentation Capability:**

☒ Segmented requests supportedWindow Size 8

☒ Segmented responses supportedWindow Size 8

**Standard Object Types Supported:**

Vacon 100 product range supports:

- Device Object
- Analog Value Object
- Binary Value Object



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The Analog Values that are *commandable* contain the *priority array* and *relinquish default* properties. All Analog Values that are not *commandable* become writable when the *out of service* property is set to true.

The Binary Values that are *commandable* contain the *priority array* and *relinquish default* properties. All Binary Values that are not *commandable* become writable when *out of service* property is set to true.

**Device Object**

| Object property | Readable | Writable |
|---|---|---|
| object-identifier | x | |
| object-name | x | |
| object-type | x | |
| system-status | x | |
| vendor-name | x | |
| vendor-identifier | x | |
| model-name | x | |
| firmware-revision | x | |
| application-software-version | x | |
| description | x | |
| protocol-version | x | |
| protocol-revision | x | |
| protocol-services-supported | x | |
| protocol-object-types-supported | x | |
| object-list | x | |
| max-apdu-length-accepted | x | |
| segmentation-supported | x | |
| max-segments-accepted | x | |
| local-time | x | |
| local-date | x | |
| apdu-segment-timeout | x | |
| apdu-timeout | x | |
| number-of-apdu-retries | x | |
| max-master | x | |
| max-info-frames | x | |
| device-address-binding | x | |

| Object property | Readable | Writable |
|---|---|---|
| database-revision | x | |
| active-cov-subscriptions | x | |

**Analog Value Object**

| Analog Value Object - Commandable | | | |
|---|---|---|---|
| **Object property** | **Readable** | **Writable** | **Commandable** |
| object-identifier | x | | |
| object-name | x | | |
| object-type | x | | |
| present-value | x | | x |
| status-flags | x | | |
| event-state | x | | |
| out-of-service | x | x | |
| units | x | | |
| priority-array | x | | |
| relinquish-default | x | x | |
| cov-increment | x | x | |

| Analog Value Object - writable when out-of-service is set true | | |
|---|---|---|
| **Object property** | **Readable** | **Writable** |
| object-identifier | x | |
| object-name | x | |
| object-type | x | |
| present-value | x | * x Normally 'read only' but becomes writable when out-of-service set to true |
| status-flags | x | |
| event-state | x | |
| out-of-service | x | x |
| units | x | |
| cov-increment | x | x |



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**Binary Value Object**

| Binary Value Object - Commandable | | | |
|---|---|---|---|
| **Object property** | **Readable** | **Writable** | **Commandable** |
| object-identifier | x | | |
| object-name | x | | |
| object-type | x | | |
| present-value | x | | x |
| status-flags | x | | |
| event-state | x | | |
| out-of-service | x | x | |
| priority-array | x | | |
| relinquish-default | x | x | |

| Binary Value Object - writable when out-of-service is set true | | |
|---|---|---|
| **Object property** | **Readable** | **Writable** |
| object-identifier | x | |
| object-name | x | |
| object-type | x | |
| present-value | x | * x Normally 'read only' but becomes writable when out-of-service set to true |
| status-flags | x | |
| event-state | x | |
| out-of-service | x | x |
| priority-array | x | |
| relinquish-default | x | x |

**Data Link Layer Options:**

MS/TP master (Clause 9), baud rate(s): 9600,19200,34800, 76800 (supports autobaud detection)

BACnet IP, (Annex J), Foreign Device

**Device Address Binding:**

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes ■No

**Networking Options:**

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

☐ Annex H, BACnet Tunneling Router over IP

☐ BACnet/IP Broadcast Management Device (BBMD)

**Character Sets Supported:**

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☒ ISO 10646 (UTF-8) ☐ IBM™ /Microsoft™ DBCS ☐ ISO 8859-1

☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS X 0208



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